



# AEC-NASA TECH BRIEF



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## Recent Development in Organic Scintillators

In a swiftly developing area such as organic scintillators, periodic reviews of recent developments are desirable. Since its conception in 1947, the field of study of organic scintillators has become so vast, however, that discussion of all aspects is nearly impossible. A limited discussion of a few recent developments could include (i) studies of some organic compounds that form glass-like masses which scintillate and are stable at room temperature, (ii) some correlations between the molecular structure of an organic scintillator and self quenching, (iii) some recently developed fast scintillators, and (iv) some newly developed applications of liquid-scintillation counters.

Discussion of the glass-like scintillators is of particular value; they can be applied for high-efficiency, fast scintillators that can be readily formed for special geometries and applications. Scintillation studies of organic compounds, in a supercooled molten state, gave results concerning the properties of the organic scintillators that form glass-like masses.

Eleven derivatives of 2-phenyl indole and two derivatives of *p*-quaterphenyl were studied. The crystals of these low-molecular-weight organic compounds were melted and recooled to room temperature, yielding rather stable nonrecrystallizing supercooled melts; their consistencies at room temperature varied from rather viscous oils to rigid glass-like masses; their stabilities also varied widely—from 1 day to at least several years.

The response of these amorphous, pure scintillators to excitation by energetic electrons was measured relative to a standard liquid-scintillator solution (gas-free solution of PPO in toluene at 3 g/liter) that was assigned a value of 100. The very stable (at least several years) and rather rigid melt of 1<sup>2</sup>, 2<sup>3</sup>, 3<sup>2</sup>,

4<sup>3</sup>-tetramethyl-*p*-quaterphenyl exhibited a relative response of 92. The supercooled melt of *N*-isoamyl-3,2'-ethylene-2-phenyl indole showed a relative response of 125 and remained amorphous, with a consistency at room temperature of a thick grease, longer than 9 months when maintained under evacuated conditions.

The fluorescence spectra of these compounds in the undiluted, supercooled state and in a toluene solution (mole fraction of about 0.001) were measured for excitation by 315-mμ radiation. In some cases there were differences in the measured spectra, depending upon the structure of the organic molecule.

One practical consequence of a fast scintillator is that quenching processes become less effective as the decay time becomes shorter. Some of the *p*-oligophenylene series of compounds have decay times shorter than 1 nsec.

Liquid-scintillator solutions have been used for measurement of radioactive gases (such as Xe, Kr, and Rn) and for determination of low levels of alpha activity (down to 0.1 displacement per minute).

### Reference:

1. D. L. Horrocks, *Develop. Appl. Spectroscopy* **6**, 145 (1968); ——— and H. O. Wirth, *J. Chem. Phys.* **47**(9), 3241 (Nov. 1967).

### Notes:

1. This information may interest organizations using radioisotope-tracer techniques, and medical-research groups requiring large and specially shaped scintillators.
2. Inquiries may be directed to:  
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(continued overleaf)

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**Patent status:**

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